

been those of omission, and common to most authors. Of the high value of the work as a text-book of public health there can be no question; and we hope that Mr. Blyth's manual will be in the hands, not only of students, but of all those whose calling is sanitary science.

J. H. E. BROCK.

OUR BOOK SHELF.

Lehrbuch der Zoologie für Studierende und Lehrer. Von Dr. J. E. V. Boas. Mit 378 Abbildungen. (Jena: Gustav Fischer, 1890.)

THIS newly published manual of zoology is a translation of the author's work, which was published in Danish in 1888. It is written from the modern standpoint, dwelling rather on the embryological and structural details of the forms of animal life, and using the scheme of classification as a subject of secondary importance. While the present volume is based on the author's previous work, it is no mere translation; not only is there a quite new chapter added under the heading of "Biology," in which the distribution of animals on land, sea, and fresh water, parasitism, non-locomotory animals, and such like subjects are briefly discussed, but changes have been made in the species of animal forms selected for illustration when those previously selected would not have been easily attainable by the German student. New figures have been introduced, and the work has generally been revised. The author warmly thanks Prof. Spengel, of Giessen, for much help rendered in the revision of the translation, German not being Dr. Boas's mother tongue. The first portion of this manual treats of the cells and tissues, the various organs or systems, development, and phylogeny, and includes the chapter above-mentioned on biology, and on the distribution of animals in space and time. The special portion treats of the classes of animals, from the Protozoa to Mammalia. Certain groups, the position of which is uncertain, are treated as "appendages" to the larger ones, such as the Sponges to the Coelenterates, the Tunicates to the Vertebrates, &c. Possibly, from the student point of view, this is going too far afield. Another point that struck us in a perusal of this volume was the absence of all references to the work of others in the field of zoology. We are very far from suggesting that it would be desirable to refer, in a necessarily compressed statement of facts, to the first discoverer of, or recorder of, the same; but there have been some epoch-making discoveries, such as have revolutionized our ideas of development, structure, and classification, and we think it a good plan to let the student know the names of the authors of these, as we fancy that, by doing so, the facts are all the more impressed upon his mind. In some few cases we would even go further, and, by telling the student where to look for further details, try and interest him in bibliography. It may be as well to add that in an indirect way this reference to the labours of others is, in a few instances, made in this volume, for some of the illustrations are inscribed as "after Allmann, Huxley, Weismann, Sars," &c.

The great majority of the figures are well selected, and the volume of nearly six hundred pages is published in a style worthy of the firm which introduced Balfour's "Comparative Embryology" to the German student, and that has introduced to us the works of the Hertwigs, Kölliker, Lang, Weismann, and others.

A Pocket-book of Electrical Rules and Tables. Seventh Edition. By John Munro, C.E., and Andrew Jamieson, M.Inst.C.E., F.R.S.E. (London: Charles Griffin and Co., 1891.)

THE rapid progress made in the application of electricity for various purposes makes it necessary for every engineer

to carry about with him some book to which he may refer. The present work has for some time been a boon to many, and its value has been increased by the improvements in the new edition. Among several additions by which the book is enriched is an article on telephony, by J. D. Miller. Not the least important item is the admirable and well-arranged index, which in a work of this kind is so essential.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

"Modern Views of Electricity"—Volta's so-called Contact Force.

DR. LODGE's treatment of this subject at pp. 107-114 of his book presents at first certain difficulties. It is in the hope that he or some of his numerous readers may give a fuller explanation that I communicate them to NATURE.

We are told (p. 112) that a piece of isolated zinc has potential 1·8 volts below that of the surrounding air. This, it is said, is owing to the affinity of zinc for oxygen, and to the fact that atoms of oxygen combining with the zinc bring with them negative electricity. But (p. 110) the zinc cannot thus combine with many atoms, receiving their charges, without becoming so negatively charged as to repel oxygen atoms electrically as much as it attracts them chemically. This, indeed, may be considered as the state of equilibrium which is instantaneously attained.

In this passage Dr. Lodge does not explain how the oxygen atoms come by their negative charge. We can understand how they come to have it in electrolysis, to which we are told to compare the Volta phenomena. In case of electrolysis, oxygen atoms, seeking to combine with zinc, have first to dissolve partnership with atoms of hydrogen, and the condition of that dissolution of partnership is that oxygen goes away with a negative, and hydrogen with the corresponding positive charge. But in air atoms of oxygen exist only in combination with other like atoms, forming molecules of oxygen. And unless these molecules are negatively charged, it is difficult to see why on their dissolution the atoms combining with zinc are charged negatively.

We are told further (p. 110) that when metallic contact is made between zinc and copper, a rush occurs of positive electricity from copper to zinc, and of negative from zinc to copper, bringing both metals to a common potential 1·3 volts below the surrounding air. If that be so, the equilibrium which we said was attained in the case of the zinc is destroyed. The zinc, having by this rush been deprived of part of its negative charge, it can no longer be true that it "repels oxygen atoms electrically as much as it attracts them chemically." We should expect that a further combination of oxygen with zinc would take place, renewing the negative charge on the zinc, and causing a further rush of positive electricity from the copper. In fact, the conditions of equilibrium, when copper and zinc are in contact, seem to be unexplained.

Again, to explain the Thomson experiment with the aluminium needle (p. 111), Dr. Lodge says that the air near a couple of zinc and copper plates in contact is in a state of electrostatic strain, being at higher potential near the zinc than near the copper. But why should this be so if the two metals are at a common potential? And is it not inconsistent with the statement that the two metals are at a common potential 1·3 volts below the surrounding air? S. H. BURBURY.

WITH much pleasure do I reply to Mr. Burbury's questions concerning the Volta effect, but must refer him to my memoir on the subject, "Seat of E.M.F. in Voltaic Pile," published by Messrs. Taylor and Francis, for the complete statement and argument, of which only a brief and picturesque summary is given in "Modern Views."

(1) The difficulty which Mr. Burbury mentions concerning the electric charge of gas atoms is a very real one, but it is not a difficulty peculiar to Voltaic doctrine; and, however it is to be accounted for, the fact that gas atoms are charged seems well

established by recent researches on gaseous conveyance of electricity and vacuum-tube phenomena. This, however, is a large subject, and cannot yet be regarded as by any means satisfactorily understood; though everything points to the fact that gases transmit currents by atomic convection, *i.e.* electrolytically.

(2) When copper touches zinc, the previous state of equilibrium is disturbed, and a fresh equilibrium is set up, into which dielectric strain in the surrounding insulator enters as a prominent component. Attack of the zinc, and continuous progression of electricity, are precisely what then tend to occur, being only prevented by the insulating character of the medium. Permit it to conduct, and the whole at once becomes a Voltaic cell on closed circuit.

(3) If the potential of a metal is defined as Sir W. Thomson defines it, *viz.* as the potential energy of a unit charge in the air close to the metal, the statement quoted from p. 111 must of course be modified; but if, as I believe, true. An intrinsic step of potential exists between each metal and the air in contact with it, which step is constant for each metal and calculable from thermo-chemical data; if therefore by metallic contact two metals be forced to the same potential, it at once follows that a slope of potential is set up in the air from one to the other. This is the very thing observed in all static Volta experiments, and has been cursorily stated as if it were a difference of potential between the metals themselves.

I think Mr. Burbury will find this quite clear if he does me the honour to read the complete argument; but if he still perceives a difficulty, I shall be much interested in hearing from him further.

OLIVER J. LODGE.

Attractive Characters in Fungi.

It is to be hoped that the interesting discussion on the colours and attractive characters of fungi may induce someone, with the requisite time and patience, to undertake a study in this rich field of investigation, which has scarcely been entered. In a paper published in the *Annals of Botany* (vol. iii., No. 10, May 1889) it is shown that among the Phalloidei the coloration, odour, and contrivances for the attraction of insects for the dispersion of the spores are as remarkable as those possessed by many Phanerogams for cross-fertilization. Among 1288 species of fungi, other than Phalloids, tabulated from Bulliard's "Champignons de la France," Tulasne's "Fungi Hypogæi," and Cooke's "Agarici," the proportion of those with inconspicuous colours is about 73 per cent., while among the Phalloids the proportion is under 2 per cent.; 90 per cent. of the latter being either red or white. According to Köhler and Schubler, as quoted by Balfour, the proportion of inconspicuously coloured flowers, among 4197 species tabulated, is about 4 per cent., the proportion of red and white being slightly over 50 per cent. Seventy-six per cent. of Phalloids have functionally attractive odour, and only 9.9 per cent. of flowers; and 18.6 per cent. of these fungi have rayed or stellate forms, so common among flowers—a shape which I have shown by measurement and experiment to be that which gives the maximum conspicuousness at moderate distances (*i.e.* within the range of insects' vision) with the minimum expenditure of material. In *Coprinus*, where the spores become immersed in black and frequently very fetid fluid, some species appear to resemble certain composite flowers which are visited by large numbers of flies, and Dr. Haas has found glucose in the hymenial fluid. There are reasons to suppose that the fætor developed by *Phallus* may be due to the secondary action of putrefactive bacteria.

From analogy it is probable that the colours and many of the characters in other groups are not adventitious, but have been selected to aid in the preservation of the species; *e.g.* the *Perizæ* are even more brilliantly coloured than the Phalloidei, and have the hymenial surface and spores freely exposed, and many small forms (*Amanita*, *Mycena*) are beautifully coloured, and grow in places where insects abound. In other cases the colours are no doubt protective by inducing resemblance, or by conspicuousness, as in many brightly-coloured poisonous forms (procrystic and aposematic colours of Poulton). I would suggest that in some cases the glutinous character referred to by Mr. Worthington Smith and Dr. Cooke may be protective against the attacks of animals, as insects and slugs. Of hundreds of specimens of *Phallus impudicus* which I have examined, I never

found the gelatinous layer eaten through by slugs, although the spongy stem after emergence from the volva is frequently so eaten, and numbers of Agarici and other forms not so protected are attacked by insects and slugs. It is known that the mucoid secretion of slugs tends to protect them from the attacks of birds and ants, and other enemies.

T. WEMYSS FULTON.

20 Royal Crescent, Edinburgh, January 10.

The Morphology of the Sternum.

MY friend Prof. T. J. Parker has in these pages (Dec. 11, 1890, p. 142) lately recorded the existence of a sternum in the shark *Notidanus indicus*. The anterior of the two cartilages which he figures has been already described by Haswell (Proc. Linn. Soc. N.S.W., vol. ix., part 1); and, in view of Parker's conclusions, it is interesting to note that he speaks of it (p. 23) as "temptingly like the presternal," but that "the presence of such an element in the skeleton of any group nearer than the Amphibia seems to preclude this explanation." That the Amphibian sternum is for the most part, if not wholly, a derivative of the shoulder-girdle, there can no longer be a question; and, although the researches of Goette leave us in doubt concerning the hypo (post-omo) sternum, they show that that can be no derivative of the costal apparatus. Working anatomists will realize in Parker's application of Albrecht's terminology the expression of a fundamental difference between the sternal skeleton of the Ichthyopsida and Amniota. The researches of Goette, Hoffmann, Ruge, and others, show the sternum of the higher Amniota to consist of a greater costal portion and of lesser ones, chief among the latter being the episternum or interclavicle. They suggest (especially if Hoffmann's assertion that the precoracoid or clavicular bar is, in Mammals, primarily continuous with the spine of the scapula) that the interclavicle may be, throughout, the vanishing vestige of the coracoidal sternum of the Ichthyopsida. The latter would appear, therefore, to have been replaced in time by the more familiar costal sternum, derivative of the hæmal arches (ribs); and, this being so, might we not boldly, and with advantage, go a step further than Parker has done, and distinguish between a coracoidal *archisternum* of the Ichthyopsida, and a hæmoeoracoidal *neosternum* of the Amniota? If this be conceded, the characters referred to must be incorporated in our diagnoses of the two great types named.

G. B. HOWES.

South Kensington, January 12.

Stereoscopic Astronomy.

THE following exquisite test of the delicacy to which astronomical photography has attained may be interesting. In Admiral Mouchez's "Photographie Astronomique" (1887)—a small book, and cheap—are eight photographs of Jupiter, by the M.M. Henry, taken on April 21, 1886. Several are at intervals of only three minutes in time. What with the large red spots, the irregularities of the two belts, and white spots on the upper belt, there are quite details enough to enable the eye to perceive the solidity of the planet, in a stereoscope, if the earlier picture is submitted to the right, and the later to the left eye. Reversing the order of the pictures gives a puzzling effect, which, with a little practice, is seen to be hollowness instead of solidity. But the mind resents this true result, and so gets puzzled.

To satisfy myself that I was not, on the other hand, misled by the wish to see solid, I put the matter to the proof by asking a friend to shuffle the photographs, and submit any two to me in the stereoscope without either of us knowing which they were, or in which order they were placed. After recording my judgment, "solid" or "hollow," on each pair, the times and order of place were ascertained and recorded. I found that I was able, after twenty trials, not only to say whether two images taken three minutes apart were rightly or wrongly placed in the stereoscope, but I could guess in any case with some accuracy what the interval was before either of us knew it. This, of course, was only possible by familiarity with these particular images.

W. J. H.

Lawn-Upton, Littlemore, January 17.

Mock Sun.

LAST evening, about five minutes after five o'clock, I observed that a cloud in the south-west was strongly illuminated from below. As the sun had set more than half an hour, and considerably more to the south, I was surprised by the degree of